methods either because they are widely used or because they have shown their value in tests made by him or under his supervision. Dr. Johansen's experience and his well-known contributions to technique guarantee the value of his recommendations. It is true, of course, in a field in which experience varies so greatly and in which success is dependent upon so many uncontrollable factors, including the personal one, that any experienced technician will find reason to question some of the author's conclusions and to regret certain of his omissions. However, granting limitations of space, no one writer probably could have made a better selection.

The subject-matter is presented clearly and fully enough to be usable by a beginner. On the other hand, so much is included and so many useful hints as to detail are presented that the book will be of value to all workers in its field, however extensive their experience. The author has given us an important and a thoroughly up-to-date contribution.

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REPORTS

COOPERATIVE INVESTIGATIONS OF THE RELATION BETWEEN MOSQUITO CONTROL AND WILDLIFE CONSERVATION[1]

SINCE the creation of the Tennessee Valley Authority in 1933, the Tennessee River has been converted into a series of large reservoirs. This change from river to lake conditions has necessitated certain major biological readjustments within the area. These adjustments concern not only the valuable wildlife and fisheries of the region, but create potential hazards to the health of man, particularly with regard to increased production of anopheline mosquitoes capable of transmitting malaria. Although these attendant changes are not unique to the Tennessee Valley, but have occurred, or will occur, in other large impoundments in the South, nevertheless the Authority has felt obligated to investigate the possible conflict between malaria control procedures and wildlife conservation.

On February 28, 1939, a meeting was held in Knoxville, Tennessee, which was attended by representatives of the Federal Bureau of Biological Survey, Public Health Service, Bureau of Fisheries, Bureau of Entomology and Plant Quarantine, and departments of the TVA interested in wildlife conservation and mosquito control. A second meeting was held on May 8. After full discussion of mutual interests, a Technical Committee was appointed to carry on a cooperative field study to obtain information on the nature and extent of the effect of mosquito larvicides and of water-level fluctuation upon fish and waterfowl, or upon their food supply; to consider possible substitution or modification of practices where damage was established; and to provide a mechanism for the coordination of the interests of the participating agencies. Representatives of the interested state agencies were invited to participate.

Members of the Technical Committee investigated the various problems jointly in the field, chiefly in Wheeler Reservoir,[2] during the summer of 1939. The continuous fluctuation of the water-level for anopheline control, together with the "over-all" fluctuations for flood control, navigation and other purposes, rendered it extremely difficult to separate the exact influence of these factors from one another and from other malaria control procedures. Variation of water-level results in the invasion of species of vegetation adaptable to such conditions. Certain of these species are undesirable, both from the viewpoint of wildlife conservation and malaria control. Wide variation of water-level inhibits the growth of submerged vegetation and of most of the indigenous emergent species of high value for waterfowl. Fluctuation also has a marked effect upon the qualitative and quantitative distribution of aquatic organisms.

Studies were conducted on the influence upon aquatic fauna and flora of the routine use of Paris green (applied by airplane at the rate of about one pound per acre) for the control of the malaria mosquito, *Anopheles quadrimaculatus*. These treatments showed no deleterious effect upon vegetation, and gave no evidence of a catastrophic destruction of aquatic organisms important as fish food. The great variability of conditions and the complicating factors in the experimental areas rendered these studies extremely difficult. For these reasons the data were inadequate to measure partial changes in the fauna which may have resulted. Chemical analyses of soil samples showed that arsenical residues accumulate in the bottom of the reservoirs in variable amounts.

In a general study, extending beyond the limits of the Tennessee Valley, on the effect of various poisons upon the physiology of fishes, representatives of the Bureau of Fisheries, working more or less independently of the studies of the Technical Committee, showed that, while arsenic accumulates in the fish of TVA reservoirs, the quantities stored to date in fishes are insufficient to be a menace to human consumption. This study is being continued to evaluate any additional storage which may develop. However, fish

[1] Report of the Technical Committee, May 14, 1940.

[2] A wildlife refuge was established in this reservoir by executive order, in August, 1938.

from these reservoirs gave evidence of disturbed metabolism, resulting possibly from malaria-control measures or other operations of the project.

Attention was also given to the effect of larvicidal oil (4 parts kerosene and 1 part black oil) as used routinely for mosquito control during 1939. Comparisons were made with kerosene (plus a dye as a marker) and with pyrethrum larvicide. The three materials showed similar results in that their deleterious effect was chiefly confined to the amphipods, of which a large proportion was destroyed. The larvicidal oil was toxic to vegetation when applied in excessive quantities, but resultant damage was more or less of a temporary nature, except that there was some evidence to indicate a tendency toward prevention of seed formation. Kerosene appeared to be the toxic constituent.

At a meeting of the participating agencies in Chattanooga, Tennessee, on February 28, 1940, it was agreed that the joint field study had resulted in the coordination of interests and that it should be continued during the summer of 1940. Investigations to be included are: (1) the relation of various species of aquatic vegetation to the production of *A. quadrimaculatus;* control of species of vegetation inimical to mosquito control and wildlife interests; and experimental plantings of species of vegetation desirable for wildlife propagation and relatively innocuous in mosquito production, (2) the biological influence of fluctuation of water-levels, (3) the source, rate of accumulation and the form in which arsenical residues occur in the bottom of the reservoir and the toxicity of these residues to aquatic fauna and flora, (4) the direct influence of Paris green and larvicidal oil on fish life, (5) natural predators of anopheline larvae, (6) the utilization of such supplementary malaria-control procedures as dykes, low-head dams, screening and mosquito-proofing; the restriction of land use to daytime occupation, and (7) new mosquito larvicides.

E. L. BISHOP,
Chairman, Policy Committee

SPECIAL ARTICLES

PANTOTHENIC ACID AND NUTRITIONAL ACHROMOTRICHIA IN RATS

DEPIGMENTATION of the fur, so-called "graying" in black and piebald animals and "rusting" in albino animals, can be produced with great regularity in rats fed a vitamin B-free basal diet (casein 18 per cent., sucrose 68, melted butterfat 8, cod liver oil 2, salt mixture 4) supplemented with thiamine, riboflavin and vitamin B_6 in an amount of 20 micrograms of each daily.[1-4] If the diet is devoid of vitamin B_6, this syndrome is less frequently observed, owing probably to the phenomenon of competition of vitamin-deficiency diseases—a B_6 deficiency *versus* lack of the anti-gray-hair factor.[5]

It has been shown[4] that purified but still crude concentrates of pantothenic acid with a degree of purification varying up to 50 per cent. had a definitely curative effect on this nutritional achromotrichia in rats. Thus it has been concluded that these concentrates contained a specific factor concerned in the cure of depigmentation of the pelt. This factor has been found to be heat labile; autoclaving of an alkaline solution destroyed the activity of the concentrates.

Although the parallelism between biological activity and grade of purification as well as heat lability of pantothenic acid favored the assumption that the specific anti-gray-hair factor is identical with pantothenic acid in the concentrates tested, the corresponding final conclusion had to be deferred until the experiments could be repeated with pure pantothenic acid.

Recently Nielsen, Oleson and Elvehjem[6] have reported the isolation of a crystalline substance which, when fed at 15 micrograms per rat per day, prevented achromotrichia. This substance was different from pantothenic acid. These authors point out that "the factor preventing nutritional achromotrichia should be clearly differentiated from pantothenic acid."

With the production of synthetic pantothenic acid,[7] sufficient amounts of the pure substance became available[8] for the study of its activity in nutritional achromotrichia in rats.

A large number (30) of rats suffering from deficiency of pantothenic acid with its different manifestations[4, 9] was treated with graduated doses of pantothenic acid. In this group 12 piebald and black animals were included, 6 of which had localized and 6 more extensive, generalized achromotrichia. The therapeutic effect of pantothenic acid on the depigmentation of the fur was prompt and definite. With the administration of daily doses of from 75 to 100

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[2] A. F. Morgan, B. B. Cook and H. G. Davison, *Jour. Nutrition*, 15: 27, 1938.
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[5] P. György and H. Goldblatt, *Jour. Exper. Med.*, 70: 185, 1939.
[6] E. Nielsen, J. J. Oleson and C. A. Elvehjem, *Jour. Biol. Chem.*, 133: 637, 1940.
[7] R. J. Williams and R. T. Major, SCIENCE, 91: 246, 1940.
[8] Synthetic pantothenic acid was generously put at our disposal by Merck & Co., Inc., Rahway, N. J.
[9] P. György and R. E. Eckardt, *Nature*, 144: 512, 1939.